

Predicting Behavioural Intention of Manufacturing Engineers in Malaysia to Use E-Learning in the Workplace

Ai Ping Teoh et Yen Shi Tan

Volume 21, numéro 4, novembre 2020

URI : <https://id.erudit.org/iderudit/1074609ar>

DOI : <https://doi.org/10.19173/irrodl.v21i4.4919>

[Aller au sommaire du numéro](#)

Éditeur(s)

Athabasca University Press (AU Press)

ISSN

1492-3831 (numérique)

[Découvrir la revue](#)

Citer cet article

Teoh, A. & Tan, Y. (2020). Predicting Behavioural Intention of Manufacturing Engineers in Malaysia to Use E-Learning in the Workplace. *International Review of Research in Open and Distributed Learning*, 21(4), 20–38.
<https://doi.org/10.19173/irrodl.v21i4.4919>

Résumé de l'article

This study aims to understand factors that affect the behavioural intention of manufacturing engineers in Malaysia to use e-learning in the workplace. Two hundred usable online questionnaires were collected from respondents who were engineers in Malaysian manufacturing companies. The data were analyzed using SPSS and Smart PLS version 3.2.6. Results supported all direct relationships except for the influence of prior experience in perceived ease of use. Interestingly, perceived usefulness and perceived ease of use fully mediated between computer self-efficacy and behavioural intention to adopt. The study provides theoretical implication to the technology acceptance model by confirming the mediating role of perceived ease of use and perceived usefulness in the context of a manufacturing setting in an emerging market. In practical terms, the study provides insights to guide organizations in designing e-learning systems that are well-received by employees at the workplace.

Copyright (c) Ai Ping Teoh et Yen Shi Tan, 2020



Ce document est protégé par la loi sur le droit d'auteur. L'utilisation des services d'Érudit (y compris la reproduction) est assujettie à sa politique d'utilisation que vous pouvez consulter en ligne.

<https://apropos.erudit.org/fr/usagers/politique-dutilisation/>

érudit

Cet article est diffusé et préservé par Érudit.

Érudit est un consortium interuniversitaire sans but lucratif composé de l'Université de Montréal, l'Université Laval et l'Université du Québec à Montréal. Il a pour mission la promotion et la valorisation de la recherche.

<https://www.erudit.org/fr/>

November – 2020

Predicting Behavioural Intention of Manufacturing Engineers in Malaysia to Use E-Learning in the Workplace

Ai Ping Teoh and Yen Shi Tan

Graduate School of Business, Universiti Sains Malaysia, Malaysia

Abstract

This study aims to understand factors that affect the behavioural intention of manufacturing engineers in Malaysia to use e-learning in the workplace. Two hundred usable online questionnaires were collected from respondents who were engineers in Malaysian manufacturing companies. The data were analyzed using SPSS and Smart PLS version 3.2.6. Results supported all direct relationships except for the influence of prior experience in perceived ease of use. Interestingly, perceived usefulness and perceived ease of use fully mediated between computer self-efficacy and behavioural intention to adopt. The study provides theoretical implication to the technology acceptance model by confirming the mediating role of perceived ease of use and perceived usefulness in the context of a manufacturing setting in an emerging market. In practical terms, the study provides insights to guide organizations in designing e-learning systems that are well-received by employees at the workplace.

Keywords: e-learning, workplace learning, behavioural intention, Malaysia

Introduction

In today's dynamic business environment, organizational learning is key to achieving sustainable competitive advantage. Through organizational learning, businesses are able to increase employees' competencies, enhance decision making, and fulfill needs such as cost effectiveness while addressing knowledge gaps (O'Brien, McCarthy, Hamburg, & Delaney, 2019). As such, organizations should focus on workplace learning processes where organizational learning effectiveness determines competitiveness.

Information technology has enabled knowledge to be created, saved, and shared in the workplace (Yoo & Huang, 2015). The evolution of digital technology has made a wide range of tools and applications available in the market to enhance teaching and learning processes (Werkel, Schmidt, Dikke, & Schwantzer, 2015) such that e-learning now greatly influences all learning that takes place in organizations. Batalla-Busquets and Pacheco-Bernal (2013) found European bank workers perceived e-learning as a more adaptable and current training methodology. Teräs and Kartoğlu (2017) discovered that a well-designed e-learning process is similar to the way professional learning occurs in workplace settings. Ravenscroft, Schmidt, Cook, and Bradley (2012) recommended organizations effectively design social media for workplace learning.

Driven by the dynamism of organizations' human capital development in the digital era as well as the new norm of workplace training post-Covid-19, this study aims to address current research gaps and further explore the interplay of key determinants that may predict behavioural intention to use e-learning in the workplace.

One of the Malaysian government's strategies under the *Ninth Malaysia Plan* was to build world-class human capital. E-learning was at the forefront of this strategy and the government took initiatives to establish the National Steering Committee for e-learning. In 2018, Internet users numbered 28.7 million or 87.4% of the population, showing a significant increase, while the use of the Internet at the workplace increased to 61.9% in the same year (Malaysian Communications and Multimedia Commission, 2020). The Internet has indeed transformed how people search for information and learn for work-related matters.

The manufacturing sector made up 22.3% of Malaysia's gross domestic product in 2019 (Department of Statistics Malaysia, 2020). Engineers are technical personnel who work on design, testing, problem solving, and product development, playing a crucial role in the operation of manufacturing firms. As engineers are knowledge-based workers, their learning needs to be always up-to-date and continuously improved to support organizational sustainability. The e-learning system is vital to nurturing the competencies of engineers. Hence, understanding factors influencing engineers' behavioural intention to use e-learning at the workplace is crucial.

Behavioural intention to use e-learning is very much dependent on factors such as a user's previous experience, ability, computer anxiety, and education background (Holt & Brockett, 2012) and it varies across countries and cultures (Haverila & Barkhi, 2009). There are many studies that have investigated e-learning usage in the context of academic institutions (e.g., Cigdem & Ozturk, 2016).

While enterprises have embarked on technology-based training in the workplace hoping to capitalize on lower training cost as well as reliable and accessible content (Garg & Sharma, 2020), the acceptance of such e-learning at the workplace in the context of Malaysia has been unclear. Furthermore, empirical

evidence on e-learning in the workplace is scarce and outdated (Ong, Lai, & Wang, 2004; Hashim, 2008; Veloo & Masood, 2014). Therefore, this study aims to uncover the factors contributing to behavioural intention to use e-learning at the workplace among manufacturing engineers in Malaysia.

Significance of Study

Theoretically, this research integrated social cognitive theory (SCT) and the technology acceptance model (TAM) in predicting behavioural intention to use e-learning in the workplace, extending TAM with aspects of SCT that reflect personal, cognitive, and environmental factors. Furthermore, this study tested the mediating roles of perceived ease of use and perceived usefulness in furthering TAM.

This research is timely and contributes practically as e-learning has become crucial in developing employees' competencies to suit organizational needs in the current business dynamic. Uncovering the significant factors and addressing them allows organizations to ensure increased use of workplace e-learning through promoting behavioural intention among employees.

Despite having been conducted in Malaysia, findings from this study can be applied to emerging markets in other regions as the data were collected mainly from manufacturing engineers working in multinational corporations (MNCs). Manufacturing firms operating in emerging countries are largely MNCs from developed countries that are more advanced in terms of using e-learning systems to train technical workforces such as engineers.

Theoretical Foundation and Literature Review

Supporting Theories

Social cognitive theory (SCT) focuses on knowledge acquisition and internal mental structures (Bower & Hilgard, 1980) and emphasizes what learners know and how they come to get knowledge from the perspective of the interrelationship between the personal, behavioural, and environmental (Jonassen, 1991). The knowledge acquired potentially alters learners' subsequent behaviour. Among the important factors examined within SCT studies are computer self-efficacy and prior experience.

The technology acceptance model (TAM) examines perceived usefulness and perceived ease of use as two unique variables which are theorized to explain users' behavioural intention toward a technology. Perceived usefulness investigates the degree to which users think that the technology can enhance an outcome, while perceived ease of use concerns the degree to which users think that minimal effort is needed to adopt a technology (Davis, 1989).

As SCT is commonly used in studies involving learning, knowledge management, human resource development, and career development (Kim & Park, 2018) and TAM is fundamental in exploring determinants of information technology usage (Choudhury & Pattniak, 2020; Zheng & Li, 2020), integrating these theories is appropriate to investigating behavioural intention to use e-learning. This study adopted computer self-efficacy and prior experience from SCT as well as perceived usefulness and perceived ease of use from TAM to form an integrated research model.

Behavioural Intention to Use E-Learning in the Workplace (BI)

E-learning refers to education or learning via digital technology to acquire new skills and knowledge, and its success depends on how it's used. Behavioural intention to use an e-learning system refers to an individual's perceived likelihood of having the intention to use an e-learning system (Rezaei Dolatabadi, Ranjbarian, & Zade, 2012) and can be affected by social, technological, and organizational factors (Choudhury & Pattniak, 2020).

Behavioural intention towards e-learning was found to be positively influenced by perceived usefulness (Zheng & Li, 2020) and negatively influenced by attitude (Lee, Hsieh, & Chen, 2013) or positively influenced by both perceived usefulness and attitude (Boateng, Mbrokoh, Boateng, Senyo, & Ansong, 2016). Perceived usefulness and perceived ease of use were found to increase behavioural intention to use e-learning (Ndubisi, 2004). Lee, Hsieh, and Ma (2011) examined the influence of individual, organizational, and task characteristics, as well as subjective norms as determinants of behavioural intention to use e-learning in an organizational context. Garg and Sharma (2020) found ease of use influenced user satisfaction which resulted in users' intention to continuously use e-training in the workplace.

Perceived Ease of Use (PEU)

Perceived ease of use (PEU) refers to an individual's degree of belief that using a system is effortless (Boateng et al., 2016). PEU and perceived usefulness (Zheng & Li, 2020) positively impact both behavioural intention to use e-learning and actual usage (Rahmawati, 2019). Nevertheless, it has been found that PEU positively influences behavioural intention only through perceived usefulness and a positive attitude toward e-learning (Lee et al., 2013).

Further studies have reinforced that PEU is a good predictor for perceived usefulness (Veloo & Masood, 2014; Elkaseh, Wong, & Fung, 2016; Zheng & Li, 2020). Prior experience and computer self-efficacy were found to positively influence PEU (Lee et al., 2013), while computer self-efficacy positively influences PEU, where PEU has a positive significant relationship towards behavioural intention (Hsia, Chang, & Tseng, 2014).

Perceived Usefulness (PU)

Perceived usefulness (PU) refers to how much a person believes that a certain technology or system can help enhance job performance (Davis, 1989). Past studies have shown that PU, either on its own (Chen & Tseng, 2012; Veloo & Masood, 2014) or together with perceived comfortableness and PEU (Hashim, 2008; Joo, Park, & Shin, 2017), is positively related to adoption of behavioural intention towards e-learning. Lee, Hsieh, and Chen (2013) found perceived usefulness had a positive influence on behavioural intention and perceived ease of use had positive influence on perceived usefulness. PU was found to be a major construct that influenced user satisfaction, which led to continual usage intention of e-learning systems by students (Lwoga, 2014).

Computer Self-Efficacy (CSE)

Computer self-efficacy (CSE) refers to the capability of a person to use a computer for task completion. CSE is a significant influence on technology usage (Compeau & Higgins, 1995) that contributes to e-learning adoption (Rahmawati, 2019) and behavioural intention to use an e-learning system for teachers and students (Khasawneh, 2015; Kim & Park, 2018). CSE predicts PU and PEU positively, and

predicts perceived credibility negatively, which, in the end, positively influences behavioural intention to use an e-learning system (Ong et al., 2004).

CSE has marginal influence on perceived behavioural control, and the perceived behavioural control strongly predicts the behavioural intention of e-learning usage (Ndubisi, 2004). This relationship is also mediated through PEU (Boateng et al., 2016). Kim and Park (2018) found CSE strongly predicted the behaviour intention for both learners and instructors, either as a mediating or direct variable.

When individuals have higher CSE, they are more likely to feel that a computer is easy to use, which causes them to perceive that an information system is also easy to use. Past studies have found that CSE has a positive influence on PEU (Boateng et al., 2016; Hsia et al., 2014; Ong et al., 2004).

When individuals have CSE, their ability to use an information system increases and influences their perception of an e-learning system's usefulness. Past studies have revealed that CSE has a positive relationship with PU (Zogheib, Rabaa'i, Zogheib, & Elsayehi, 2015; Chen & Tseng, 2012). Thus, we postulate that:

Hypothesis 1: There is a positive and significant relationship between CSE and PEU.

Hypothesis 2: There is a positive and significant relationship between CSE and PU.

Prior Experience (PE)

Prior experience (PE) refers to previous e-learning involvement and has been found to: (a) positively influence e-learning effectiveness (Haverila, 2011); (b) improve perceived behavioural control (Ndubisi, 2004); and (c) affect perceived usefulness and perceived ease of use, which, in turn, influence behavioural intention (Lee et al., 2013).

Lee et al. (2013) argued that PE has a positive and significant influence on both PEU and PU; as individuals gain more experience on how to use an e-learning system, they become more familiar with that system and then tend to perceive that the system is easy to use. PE shows that users who have previous exposure to e-learning already have some knowledge on how to use a new e-learning system. Hence, it will be easier to use e-learning. Lee et al. (2013) provided evidence that PE has a positive relationship with PU. Thus, we postulate that:

Hypothesis 3: There is a positive and significant relationship between PE and PEU.

Hypothesis 4: There is a positive and significant relationship between PE and PU.

PEU and PU

Past studies have indicated that when an individual has PEU of an e-learning system, he/she will also have PU towards that e-learning system (Zogheib et al., 2015). Furthermore, several studies have proven that PEU has a positive and significant relationship with PU (Boateng et al., 2016; Lee et al., 2013; Ong et al., 2004). Thus, we postulate that:

Hypothesis 5: There is a positive and significant relationship between PEU and PU.

PEU, PU, CSE, PE, and BI

When individuals find that e-learning is easy to use, their intention to use the e-learning system will increase. Al-Gahtani (2016) discovered that PEU positively influences behavioural intention. Most studies have supported the idea that PEU has a positive and significant relationship with BI (Lee et al., 2013; Garg & Sharma, 2020).

When individuals find an e-learning system useful, they will have the intention to use the e-learning system. Lee et al. (2013) highlighted that PU has a positive and significant relationship with behavioural intention to use e-learning. Other studies (Ong et al., 2004; Al-Gahtani, 2016) have also supported this finding.

Computer self-efficacy positively influences behavioural intention to use e-learning (Ong et al., 2004; Hsia et al., 2014). CSE contributes towards e-learning adoption (Rahmawati, 2019) and behavioural intention to use e-learning systems among teachers and students (Khasawneh, 2015; Kim & Park, 2018). However, Yuen and Ma (2008) found no significant direct relationship between CSE and BI, while Md Ariff, Yeow, Zakuan, Jusoh, and Bahari (2012) found only an indirect relationship between CSE and BI, which was through PU and PE.

Prior experience was found to positively influence behavioural intention to use e-learning in education (Lee, et al., 2013; Ndubisi, 2004) as well as in the workplace (Wang & Lin, 2014). Thus, we postulate that:

Hypothesis 6: There is a positive and significant relationship between PEU and BI.

Hypothesis 7: There is a positive and significant relationship between PU and BI.

Hypothesis 8: There is a positive and significant relationship between CSE and BI.

Hypothesis 9: There is a positive and significant relationship between PE and BI.

Perceived Ease of Use (PEU) as Mediator

Past studies have indicated that PEU is a good mediator (Venkatesh, 1999). Furthermore, positive PE of e-learning was revealed to have positive influence on the adoption of online learning (Burton-Jones & Hubona, 2006). Haverila (2011) highlighted that PE is very important to determine e-learning outcomes. Kim and Park (2018) found CSE directly and indirectly influences adoption of e-learning. Thus, we postulate that:

Hypothesis 10: PEU mediates the relationship between CSE and PU.

Hypothesis 11: PEU mediates the relationship between CSE and BI.

Hypothesis 12: PEU mediates the relationship between PE and PU.

Hypothesis 13: PEU mediates the relationship between PE and BI.

Perceived Usefulness (PU) as Mediator

As a mediator, PU positively influences the relationships of motivation, computer anxiety, Internet self-efficacy (Hashim, 2008; Joo et al., 2017), PEU, and attitude (Boateng et al., 2016) with behavioural

intention. Several studies have indicated that PU is a good mediator (Venkatesh, 1999; Burton-Jones & Hubona, 2006). Wei (2009) claimed that PU mediated the relationship of perceived compatibility of a technology system and BI. Huynh and Thi (2014) found PU mediates the relationship between PEU and BI. Thus, we postulate that:

Hypothesis 14: PU mediates the relationship between CSE and BI.

Hypothesis 15: PU mediates the relationship between PE and BI.

Hypothesis 16: PU mediates the relationship between PEU and BI.

Therefore, we developed a research model as follows (see Figure 1).

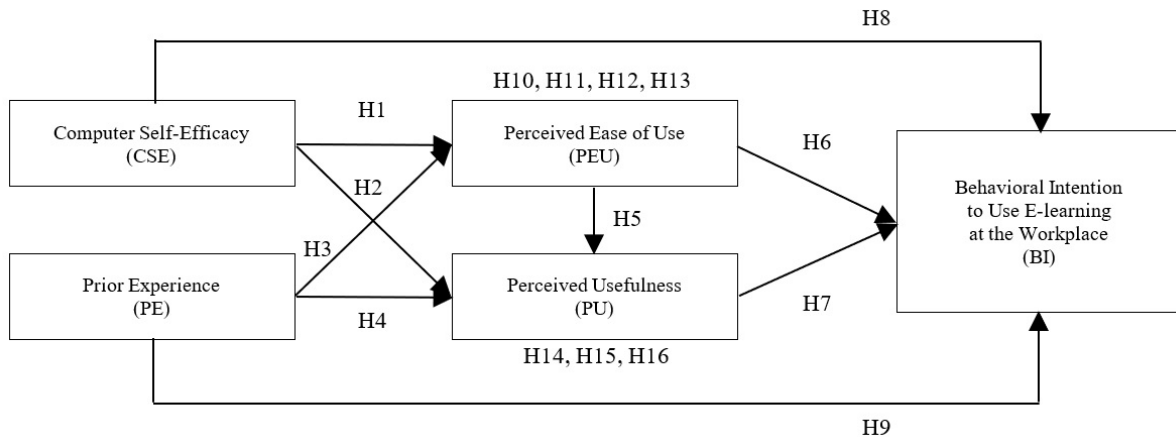


Figure 1. Research model to determine behavioural intention to use e-learning in the workplace.

In addressing gaps in literature, the research model integrates SCT and TAM to evaluate behavioural intention to use e-learning in the workplace. This study attempts to address certain SCT limitations which emphasize that learning occurs within a person and do not consider external factors (Garcia Carreño, 2014).

Most of the past SCT and TAM studies have centered on traditional learning in the classroom, and e-learning of students and teachers. This study extends the traditional TAM by testing the mediating effects of PEU and PU in predicting BI in the context of e-learning in the workplace.

Methodology

This quantitative study used non-probability purposive sampling and collected two hundred effective responses from engineers working in Malaysian manufacturing companies via an online survey conducted in November 2019. The unit of analysis was the individual. The first two sections of the questionnaire explored the organizational background, e-learning system used, and demographic information of the respondents. The third section included questions related to the predictors and mediating variables. The last section included questions on the dependent variable. A Likert-type scale was used to rate the items in each variable. Measurement items were adapted from Lee et al. (2013),

Kim and Park (2018), and Hsia, Chang, and Tseng (2014). The survey instrument was reviewed by two experts to determine its validity and clarity.

Statistical Package for Social Science (SPSS) and Smart PLS 3.2.6 were used to analyse the data. SPSS was used to do frequency and descriptive analysis as well as testing for common method variance (CMV). Smart PLS was used to analyse the measurement and structural models. The measurement model measured the outer model for validity and reliability, including discriminant validity, convergent validity, composite reliability, construct validity, and reliability analyses. The structural model measured the inner model on regression analysis and tested the hypotheses. Path coefficients were obtained in terms of direct and indirect effects. T-values and p-values were also acquired to determine whether the hypotheses should be rejected or accepted. The confidence level was set at 95%, with a significance level of 0.05 under a one-tailed test. In this study, PLS was used to perform a nonparametric bootstrap procedure based on the assumption that data were not normally distributed.

Data Analysis and Findings

Profile of Respondents

The majority of respondents were male (61%), within the age group of 26 to 30 years old (40.5%). Furthermore, 54.5% were single and possessed a bachelor's degree (68%). Most (72%) worked in large manufacturing organizations, and 79% of the respondents' companies had developed in-house e-learning systems. Slightly more than half of the companies (56.5%) did not force their employees to use e-learning systems; rather, it was on a voluntary basis.

Common Method Variance

Data were examined using SPSS; factors were unrotated, and the extraction method was principal component analysis. The results showed that six extracted factors explained 73.65% of the total variances. The first factor explained 45.13% of the variance extracted, which was less than the required criteria of 50%. Hence, there was no single factor representing a majority of the total variance extracted, and the samples were therefore considered to be free from common method bias (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003).

Assessment of the Measurement Model

Hair, Hult, Ringle, and Sarstedt (2016) recommended a cut-off value of 0.50 for significant loadings. All the individual items of each construct consisted of the highest loadings, and all the cross loadings were lower than the main loadings respectively (see Table 1). Hence, the constructs were valid.

For a variable to demonstrate convergent validity, the average variance extracted (AVE) must be more than 0.50 (Hair, Hult, Ringle, & Sarstedt, 2016). All AVE values were above the 0.50 threshold, indicating the model showed convergent validity.

Cronbach's alpha, composite reliability and Rho_A must be higher than 0.70 to demonstrate the reliability of the research model (Hair et al., 2016). Cronbach's alpha is said to have limitations as it assumes all indicators are equally reliable and have equal loadings on the construct but Rho_A is loading oriented (Hair et al., 2016). Cronbach's alpha, composite reliability and Rho_A values of each variable were higher than 0.70 (see Table 1). As such, the model was considered reliable.

Table 1

Convergent Validity

Variable	Item	Loading	AVE	Rho_A	Cronbach's Alpha	Composite Reliability
BI	BI1	0.813	0.746	0.915	0.914	0.936
	BI2	0.877				
	BI3	0.861				
	BI4	0.885				
	BI5	0.879				
PEU	PEU1	0.803	0.721	0.877	0.870	0.912
	PEU2	0.846				
	PEU3	0.921				
	PEU4	0.822				
PU	PU1	0.858	0.741	0.914	0.912	0.935
	PU2	0.880				
	PU3	0.828				
	PU4	0.872				
	PU5	0.863				
CSE	CSE1	0.879	0.678	0.861	0.841	0.893
	CSE2	0.870				
	CSE3	0.792				
	CSE4	0.744				
PE	E1	0.743	0.616	0.871	0.847	0.889
	E2	0.816				
	E3	0.807				
	E4	0.761				
	E5	0.793				

Note. BI = behavioural intention; PEU = perceived ease of use; PU = perceived usefulness; CSE = computer self-efficacy; PE = prior experience.

The heterotrait-monotrait ratio of correlations (HTMT) is recommended by Henseler, Ringle, and Sarstedt (2014) to measure discriminant validity and test if items involved in a study are unrelated in order to avoid potential bias or confusion. As a rule of thumb, the HTMT value should be below 0.9. The HTMT results in Table 2 indicate that all questions were different from one another and would not cause confusion to the respondents. Hence, the model for this study demonstrated discriminant validity.

Table 2

HTMT Criterion for Discriminant Validity

	1	2	3	4	5
1. BI	–				
2. CSE	0.644	–			
3. PE	0.350	0.537	–		
4. PEU	0.757	0.754	0.357	–	
5. PU	0.796	0.792	0.421	0.836	–

Note. BI = behavioural intention; CSE = computer self-efficacy; PE = prior experience; PEU = perceived ease of use; PU = perceived usefulness.

Standardized Root Mean Square Residual (SRMR)

To eliminate model misspecification, the standardized root mean square residual (SRMR) was calculated. The SRMR should have a value of less than 0.10 for reasonable model fit. The SRMR in this study was 0.074 indicating acceptable model fit.

Assessment of Structural Model

To assess the structural model, a one-tailed test was used with a significance level of 0.05, indicating a 95% confidence level (see Table 3).

Table 3

Path Coefficients and Hypotheses Testing (Direct Relationships)

Hypothesis	Path	Path Coefficient	T-value (One Tail)	Result
H1	CSE → PEU	0.638	8.290**	Supported
H2	CSE → PU	0.352	3.301*	Supported
H3	PE → PEU	0.033	0.351	Not supported
H4	PE → PU	0.059	0.832	Not supported
H5	PEU → PU	0.498	5.866**	Supported
H6	PEU → BI	0.297	2.974*	Supported
H7	PU → BI	0.480	4.071**	Supported
H8	CSE → BI	0.031	0.343	Not supported
H9	PE → BI	0.017	0.244	Not supported

Note. BI = behavioural intention; CSE = computer self-efficacy; PE = prior experience; PEU = perceived ease of use; PU = perceived usefulness. ** $p < 0.001$. * $p < 0.05$.

Table 4 shows the detailed results of mediation analysis. Of the seven hypotheses tested, four were supported as the indirect paths were significant. The lower and upper limits of confidence interval bias did not straddle '0', indicating there was mediation (Preacher & Hayes, 2008).

If the direct relationship between the independent variable and the dependent variable is significant and the indirect relationship is also significant, then partial mediation occurs; however, if the direct relationship is not significant while indirect is significant, then full mediation occurs (Zhao, Lynch, & Chen, 2010).

Table 4

Path Coefficients and Hypotheses Testing (Indirect Relationships)

Hypothesis	Path	Path Coef- ficient	T-value (One Tail)	Confidence Interval Bias Corrected		Result	Type of Mediation
				5% (LL)	95.0% (UL)		
H10	CSE→PEU→PU	0.318	4.464**	0.215	0.445	Supported	Partial
H11	CSE→PEU→BI	0.189	2.859*	0.091	0.306	Supported	Full
H12	PE→PEU→PU	0.017	0.347	-0.068	0.092	Not supported	None
H13	PE→PEU→BI	0.010	0.312	-0.039	0.065	Not supported	None
H14	CSE→PU→BI	0.169	2.552*	0.079	0.302	Supported	Full
H15	PE→PU→BI	0.028	0.858	-0.019	0.083	Not supported	None
H16	PEU→PU→BI	0.239	3.071**	0.126	0.384	Supported	Partial

Note. BI = behavioural intention; CSE = computer self-efficacy; PE = prior experience; PEU = perceived ease of use; PU = perceived usefulness. ** $p < 0.001$. * $p < 0.05$.

Hair et al. (2016) stated that when measuring the goodness of fit of a model using R^2 , 0.25 is weak, 0.50 is moderate, and 0.75 is strong. The R^2 values calculated in this study show an overall moderate goodness of fit. Specifically, the R^2 of perceived ease of use (PEU) was 0.428 which indicates almost moderate goodness of fit, where 42.8% of its variance can be explained by computer self-efficacy (CSE) and prior experience (PE). However, the R^2 of perceived usefulness (PU) was 0.645 indicating PU clearly has a moderate goodness of fit, and 64.5% of its variance can be represented by CSE, PE, and PEU. Lastly, the R^2 of behavioural intention (BI) was 0.576 showing a moderate goodness of fit, with 57.6% of its variance explained by PEU and PU.

Discussion and Implications

Hypothesis H₁, which describes a positive relationship between computer self-efficacy and perceived ease of use, was supported with a T-value of 8.290 (see Table 3). Consistent with previous studies (Lee et al., 2013; Hsia et al., 2014; Boateng et al., 2016), individuals with computer self-efficacy were found to have higher perceived ease of use with e-learning systems in the context of workplace learning. Computer self-efficacy exists if an individual can complete certain tasks using a computer. This individual perceives that the problems faced are not difficult although others might feel otherwise (Hsia et al., 2014). With computer self-efficacy, an individual feels more comfortable when using an e-learning system (Lee et al., 2013).

Hypothesis H₂, which postulates that there is a positive relationship between computer self-efficacy and perceived usefulness, was accepted with a T-value of 3.301 (see Table 3). This confirms that individuals with higher computer self-efficacy have higher perceived usefulness towards an e-learning system (Zogheib et al., 2015) in a workplace. Computer self-efficacy was a crucial factor to be considered because it had a significant and positive influence on perceived usefulness, consistent with previous findings (Chen & Tseng, 2012; Rabaa'i, 2016). Computer self-efficacy positively predicts perceived

usefulness because an individual with high computer self-efficacy also has higher learning effectiveness. Computer self-efficacy improves knowledge transfer, which leads to better practical usage of technology systems.

Hypothesis H₃, which suggests a positive relationship between prior experience and perceived ease of use, was not supported, with a T-value of 0.351 (see Table 3). This means that prior experience had no influence on perceived ease of use which contradicts several past studies discussed earlier. However, this finding may also indicate that, for an individual, prior exposure to or practice with a technology system is not a significant factor that influences the perceived ease of use (Adewole-Odeshi, 2014). Every individual has different learning characteristics which indirectly influence their thoughts towards ease of use of an e-learning system (Haverila & Barkhi, 2009). Prior experience gained by anyone may be unique. Most of the respondents in this study, being engineers, would have graduated from higher education institutions and therefore would have had experience with e-learning systems.

Hypothesis H₄, which assumes a positive relationship exists between prior experience and perceived usefulness, was not supported, with a T-value of 0.832 (see Table 3). Despite having more experience with e-learning systems, in both this study and in Lee et al. (2013), engineers' perceptions of usefulness were not influenced by prior experience.

Hypothesis H₅, which postulates there is a relationship between perceived ease of use and perceived usefulness, was supported, with a T-value of 5.866 (see Table 3). This is consistent with previous findings (Chen & Tseng, 2012; Lee et al., 2013; Punnoose, 2012) that have shown that an individual who perceives that e-learning is easy to use also directly perceives that the e-learning system is useful. Furthermore, this supports the findings of studies that have demonstrated that perceived ease of use has a significant and direct effect on perceived usefulness in e-learning adoption (Al-Gahtani, 2016; Huynh & Thi, 2014; Zogheib et al., 2015).

Hypotheses H₆ and H₇ predict that behavioural intention to use e-learning at the workplace will be positively and significantly influenced by perceived ease of use and perceived usefulness. Both hypotheses were supported with T-values of 2.974 and 4.071 respectively (see Table 3). The findings revealed that perceived ease of use and perceived usefulness were antecedents to the intention to use an e-learning system at the workplace. Since perceived ease of use, perceived usefulness, and behavioural intention to use e-learning at the workplace are the main constructs in TAM, which is a well-established research model, many past studies have provided evidence of this significant relationship (Chen & Tseng, 2012; Huynh & Thi, 2014; Al-Gahtani, 2016). It is believed that when an e-learning system is perceived to be easy to use and provides advantages at the workplace, the probability of intention to use will be higher.

Hypotheses H₈ and H₉ predict that behavioural intention to use will be positively and significantly influenced by computer self-efficacy and prior experience respectively. Both hypotheses were not supported as the T-values were 0.343 and 0.244 (see Table 3). Although previous studies (Lee et al., 2013; Wang & Lin, 2014; Ndubisi, 2004) have found significant relationships, this study suggests that prior experience does not influence behavioural intention. Surprisingly, computer self-efficacy did not directly influence behavioural intention. Similar observations have been made in previous studies such as Yuen and Ma (2008) and Md Ariff et al. (2012).

The mediating effect of the TAM beliefs (perceived ease of use and perceived usefulness) were examined in hypotheses H₁₀ to H₁₆. Full mediating effects were found for hypotheses H₁₁ and H₁₄, but H₁₀ and H₁₆ showed only partial mediation (see Table 4). This is consistent with past studies (Venkatesh, 1999; Burton-Jones & Hubona, 2006; Svendsen, Johnsen, Almås-Sørensen, & Vittersø, 2013) that have demonstrated that perceived ease of use and perceived usefulness are able to act as mediating variables in TAM. Interestingly, hypotheses H₁₂, H₁₃, and H₁₅ were not supported (see Table 4), which contradicts previous findings (Haverila, 2011; Burton-Jones & Hubona, 2006). In this study, the relationship between prior experience and perceived ease of use was not significant in the context of e-learning in the workplace. Consequently, perceived ease of use did not show a mediating effect between prior experience and perceived usefulness, and between prior experience and behavioural intention.

Theoretical Implications

This study confirms the mediating role of the TAM beliefs (perceived ease of use and perceived usefulness). Both perceived ease of use and perceived usefulness were found to mediate the relationship of the antecedents (except for prior experience) with behavioural intention to use e-learning at the workplace. This finding contributes to TAM as past studies have neglected these two beliefs as mediators. This study has also validated the integrated framework of SCT and TAM in predicting the behavioural intention to use e-learning in the workplace. Past studies were conducted mainly on students in universities, while limited studies were carried out within the industrial or workplace context, adopting either one of these theories independently.

Practical Implications

Findings from this study on the determinants of behavioural intention to use e-learning at the workplace provide guidelines to organizations on significant factors to prioritize when establishing an e-learning system. For instance, it is recommended that organizations ensure computer self-efficacy among employees before implementing an e-learning system. Computer usage culture must be instilled among the employees. Organizations should also ensure the e-learning system is both easy to use and useful for the employees. Organizations can set up a group of pioneer users before officially rolling out the new e-learning system. The pioneer users can try the e-learning system and provide feedback especially in areas of ease of use and usefulness. Organizations can then use this feedback to improve the e-learning system to fit the needs and expectations of employees.

Conclusion and Limitations

Organizational learning is essential to achieving sustainable competitive advantage in the current volatile business environment. Digital transformation in organizations has enabled e-learning at the workplace to drive organizational learning. In gauging behavioural intention to use e-learning, this study developed a research model that integrated SCT and TAM and addressed gaps in previous studies. In this study, we advanced current understanding by predicting behavioural intention to use e-learning at the workplace among manufacturing engineers in an emerging country. Computer self-efficacy was found to positively influence perceived ease of use and perceived usefulness, while indirectly predicting behavioural intention. While prior experience did not affect perceived ease of use, it influenced perceived usefulness. Perceived ease of use influenced perceived usefulness, and both positively impacted behavioural intention. Most importantly, the roles of perceived ease of use and perceived usefulness as mediators have been confirmed in the context of this study.

The scope and model of this study address the importance of individual differences. The R^2 value of the model is 0.615, where factors explained 61.5 % of behavioural intention to use e-learning systems. Thus, approximately 39 % of variances were not explained. Future studies could consider the role of other factors such as system, environment, and expectation in behavioural intention to use e-learning in the workplace. Furthermore, this study focused on the behavioural intention to use e-learning in organizations. Future studies may extend this model to assess the effectiveness of an e-learning system after usage. This study targets engineers of manufacturing organizations in Malaysia. Future studies could collect data from other industries and countries or regions to explore various contexts.

References

- Adewole-Odesi, E. (2014). Attitude of students towards e-learning in south-west Nigerian universities: An application of technology acceptance model. *Library Philosophy and Practice (e-journal)*, 1035. Retrieved from <https://digitalcommons.unl.edu/libphilprac/1035>
- Al-Gahtani, S. S. (2016). Empirical investigation of e-learning acceptance and assimilation: A structural equation model. *Applied Computing and Informatics*, 12(1), 27-50. doi: [10.1016/j.aci.2014.09.001](https://doi.org/10.1016/j.aci.2014.09.001)
- Batalla-Busquets, J.-M., & Pacheco-Bernal, C. (2013). On-the-job e-learning: Workers' attitudes and perceptions. *The International Review of Research in Open and Distributed Learning*, 14(1), 40-64. doi: [10.19173/irrodl.v14i1.1304](https://doi.org/10.19173/irrodl.v14i1.1304)
- Boateng, R., Mbrokoh, A. S., Boateng, L., Senyo, P. K., & Ansong, E. (2016). Determinants of e-learning adoption among students of developing countries. *The International Journal of Information and Learning Technology*, 33(4), 248-262. doi: [10.1108/IJILT-02-2016-0008](https://doi.org/10.1108/IJILT-02-2016-0008)
- Bower, G. H., & Hilgard, E. R. (1980). *Theories of learning* (5th ed.). Englewood Cliffs, N.J.: Prentice Hall.
- Burton-Jones, A., & Hubona, G. S. (2006). The mediation of external variables in the technology acceptance model. *Information & Management*, 43(6), 706-717. doi: [10.1016/j.im.2006.03.007](https://doi.org/10.1016/j.im.2006.03.007)
- Chen, H.-R., & Tseng, H.-F. (2012). Factors that influence acceptance of Web-based e-learning systems for the in-service education of junior high school teachers in Taiwan. *Evaluation and Program Planning*, 35(3), 398-406. doi: [10.1016/j.evalprogplan.2011.11.007](https://doi.org/10.1016/j.evalprogplan.2011.11.007)
- Choudhury, S. & Pattniak, S. (2020). Emerging themes in e-learning: A review from the stakeholders' perspective. *Computers & Education*, 144, 103657, doi: [10.1016/j.compedu.2019.103657](https://doi.org/10.1016/j.compedu.2019.103657)
- Cigdem, H., & Ozturk, M. (2016). Factors affecting students' behavioral intention to use LMS at a Turkish postsecondary vocational school. *The International Review of Research in Open and Distributed Learning*, 17(3). doi: [10.19173/irrodl.v17i3.2253](https://doi.org/10.19173/irrodl.v17i3.2253)
- Compeau, D. R., & Higgins, C. A. (1995). Computer self-efficacy: Development of a measure and initial test. *MIS Quarterly*, 19(2), 189-211. doi: [10.2307/249688](https://doi.org/10.2307/249688)
- Davis, D. F. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-340. doi: [10.2307/249008](https://doi.org/10.2307/249008)
- Department of Statistics Malaysia. (2020). *Malaysia Economic Performance 2019*. Retrieved from https://www.dosm.gov.my/v1/index.php?r=column/cthemByCat&cat=153&bul_id=bVN1KotxTSt1TVRGRFZBRE8yUoJYZzo9&menu_id=TE5CRUZCblh4ZTZMODZlBmk2aWRRQTo9
- Elkaseh, A. M., Wong, K. W., & Fung, C. C. (2016). Perceived ease of use and perceived usefulness of social media for e-learning in Libyan higher education: A structural equation modeling

- analysis. *International Journal of Information and Education Technology*, 6(3), 192-199. doi: [10.7763/IJiet.2016.V6.683](https://doi.org/10.7763/IJiet.2016.V6.683)
- Garcia Carreño, I. d. V. (2014). Theory of connectivity as an emergent solution to innovative learning strategies. *American Journal of Educational Research*, 2(2), 107-116. doi: [10.12691/education-2-2-7](https://doi.org/10.12691/education-2-2-7)
- Garg, S., & Sharma, S. (2020). User satisfaction and continuance intention for using e-training: A structural equation model. *Vision: The Journal of Business Perspective*, 1-11. doi: [10.1177/0972262920926827](https://doi.org/10.1177/0972262920926827)
- Hair, J. F., Jr., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2016). *A primer on partial least squares structural equation modeling (PLS-SEM)* (2nd ed.). Thousand Oaks, California: Sage.
- Hashim, J. (2008). Factors influencing the acceptance of Web-based training in Malaysia: Applying the technology acceptance model. *International Journal of Training and Development*, 12(4), 235-264. doi: [10.1111/j.1468-2419.2008.00307.x](https://doi.org/10.1111/j.1468-2419.2008.00307.x)
- Haverila, M. (2011). Prior e-learning experience and perceived learning outcomes in an undergraduate e-learning course. *Journal of Online Learning and Teaching*, 7(2), 206-218. Retrieved from https://jolt.merlot.org/vol7no2/haverila_0611.pdf
- Haverila, M., & Barkhi, R. (2009). The influence of experience, ability and interest on e-learning effectiveness. *European Journal of Open, Distance and E-Learning*, 12(1), 1-13. Retrieved from https://www.eurodl.org/materials/contrib/2009/Haverila_Barkhi.pdf
- Henseler, J., Ringle, C. M., & Sarstedt, M. (2014). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, 43, 115-135. doi: 10.1007/s11747-014-0403-8
- Holt, L., & Brockett, R. G. (2012). Self direction and factors influencing technology use: Examining relationships for the 21st century workplace. *Computers in Human Behaviour*, 28(6), 2075-2082. doi: [10.1016/j.chb.2012.06.011](https://doi.org/10.1016/j.chb.2012.06.011)
- Hsia, J.-W., Chang, C.-C., & Tseng, A.-H. (2014). Effects of individuals' locus of control and computer self-efficacy on their e-learning acceptance in high-tech companies. *Behaviour & Information Technology*, 33(1), 51-64. doi: [10.1080/0144929X.2012.702284](https://doi.org/10.1080/0144929X.2012.702284)
- Huynh, Q. L., & Thi, T. L. (2014). The mediating role of the perceived usefulness in the acceptance of e-learning. *International Journal of Humanities and Social Science Invention*, 3(2), 37-42. Retrieved from [http://www.ijhssi.org/papers/v3\(2\)/Version-3/F0323037042.pdf](http://www.ijhssi.org/papers/v3(2)/Version-3/F0323037042.pdf)
- Jonassen, H. D. (1991). Objectivism versus constructivism: Do we need a new philosophical paradigm? *Educational Technology Research and Development*, 39(3), 5-14. doi: [10.1007/BF02296434](https://doi.org/10.1007/BF02296434)

- Joo, Y. J., Park, S., & Shin, E. K. (2017). Students' expectation, satisfaction, and continuance intention to use digital textbooks. *Computers in Human Behaviour*, 69, 83-90. doi: [10.1016/j.chb.2016.12.025](https://doi.org/10.1016/j.chb.2016.12.025)
- Khasawneh, M. (2015). Factors influence e-learning utilization in Jordanian universities - Academic staff perspectives. *Procedia - Social and Behavioural Sciences*, 210, 170-180. doi: [10.1016/j.sbspro.2015.11.356](https://doi.org/10.1016/j.sbspro.2015.11.356)
- Kim, B., & Park, M. J. (2018). Effect of personal factors to use ICTs on e-learning adoption: Comparison between learner and instructor in developing countries. *Information Technology for Development*, 24(4), 1-27. doi: [10.1080/02681102.2017.1312244](https://doi.org/10.1080/02681102.2017.1312244)
- Lee, Y.-H., Hsieh, Y.-C., & Chen, Y.-H. (2013). An investigation of employees' use of e-learning systems: Applying the technology acceptance model. *Behaviour & Information Technology*, 32(2), 173-189. doi: [10.1080/0144929X.2011.577190](https://doi.org/10.1080/0144929X.2011.577190)
- Lee, Y.-H., Hsieh, Y.-C., & Ma, C.-Y. (2011). A model of organizational employees' e-learning systems acceptance. *Knowledge-Based Systems*, 24(3), 355-366. doi: [10.1016/j.knosys.2010.09.005](https://doi.org/10.1016/j.knosys.2010.09.005)
- Lwoga, E. T. (2014). Critical success factors for adoption of Web-based learning management systems in Tanzania. *International Journal of Education and Development Using Information and Communication Technology*, 10(1), 4-21. Retrieved from <https://www.learntechlib.org/p/147447/>
- Malaysian Communications and Multimedia Commission. (2020). *Internet Users Survey 2018*. Retrieved from [https://www.mcmc.gov.my/skmmgovmy/media/General/pdf/Internet-Users-Survey-2018-\(Infographic\).pdf](https://www.mcmc.gov.my/skmmgovmy/media/General/pdf/Internet-Users-Survey-2018-(Infographic).pdf)
- Md Ariff, M. S. B., Yeow, S. M., Zakuan, N., Jusoh, A. & Bahari, A. Z. (2012). The effects of computer self-efficacy and technology acceptance model on behavioral intention in Internet banking systems. *Procedia - Social and Behavioral Sciences*, 57, 448-452. doi: [10.1016/j.sbspro.2012.09.1210](https://doi.org/10.1016/j.sbspro.2012.09.1210)
- Ndubisi, N. O. (2004). Factors influencing e-learning adoption intention: Examining the determinant structure of the decomposed theory of planned behaviour constructs. In *Proceedings of the 27th HERDSA Annual Conference. Research and Development in Higher Education: Transforming Knowledge into Wisdom: Holistic Approaches to Teaching and Learning* (pp. 252-262). Retrieved from <https://www.herdsa.org.au/publications/conference-proceedings/research-and-development-higher-education-transforming-23>
- O'Brien, E., McCarthy, J., Hamburg, I., & Delaney, Y. (2019). Problem-based learning in the Irish SME workplace. *Journal of Workplace Learning*, 31(6), 391-407. doi: [10.1108/JWL-10-2018-0131](https://doi.org/10.1108/JWL-10-2018-0131)
- Ong, C.-S., Lai, J.-Y., & Wang, Y.-S. (2004). Factors affecting engineers' acceptance of asynchronous e-learning systems in high-tech companies. *Information & Management*, 41(6), 795-804. doi: [10.1016/j.im.2003.08.012](https://doi.org/10.1016/j.im.2003.08.012)

- Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioural research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879-903. doi: [10.1037/0021-9010.88.5.879](https://doi.org/10.1037/0021-9010.88.5.879)
- Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods* 2008, 40, 879-891. doi: [10.3758/BRM.40.3.879](https://doi.org/10.3758/BRM.40.3.879)
- Punnoose, A. C. (2012). Determinants of intention to use e-learning based on the technology acceptance model. *Journal of Information Technology Education: Research*, 11(1), 301-337. doi: [10.28945/1744](https://doi.org/10.28945/1744)
- Rabaa'i, A. A. (2016). Extending the technology acceptance model (TAM) to assess students' behavioural intentions to adopt an e-learning system: The case of Moodle as a learning tool. *Journal of Emerging Trends in Engineering and Applied Sciences*, 7(11), 13-30. Retrieved from <https://www.ingentaconnect.com/content/sabinet/sljeteas/2016/00000007/00000001/arto0003>
- Rahmawati, R. N. (2019). Self-efficacy and use of e-learning: A theoretical review technology acceptance model (TAM). *American Journal of Humanities and Social Sciences Research*, 3(5), 41-55. Retrieved from <https://www.ajhssr.com/wp-content/uploads/2019/05/F19354155.pdf>
- Ravenscroft, A., Schmidt, A., Cook, J., & Bradley, C. (2012). Designing social media for informal learning and knowledge maturing in the digital workplace. *Journal of Computer Assisted Learning*, 28(3), 235-249. doi: [10.1111/j.1365-2729.2012.00485.x](https://doi.org/10.1111/j.1365-2729.2012.00485.x)
- Rezaei Dolatabadi, H., Ranjbarian, B., & Zade, F. K. (2012). Investigate the customers' behavioural intention to use mobile banking based on TPB, TAM and perceived risk (A case study in Meli Bank). *International Journal of Academic Research in Business and Social Sciences*, 2(10), 312-322. Retrieved from <https://pdfs.semanticscholar.org/cc8a/400e0ea05ee06481ce482ea90d02e56ed32d.pdf>
- Svendsen, G. B., Johnsen, J.-A. K., Almås-Sørensen, L., & Vittersø, J. (2013). Personality and technology acceptance: The influence of personality factors on the core constructs of the technology acceptance model. *Behaviour & Information Technology*, 32(4), 232-334. doi: [10.1080/0144929X.2011.553740](https://doi.org/10.1080/0144929X.2011.553740)
- Teräs, H., & Kartoğlu, Ü. (2017). A grounded theory of professional learning in an authentic online professional development program. *The International Review of Research in Open and Distributed Learning*, 18(7). doi: [10.19173/irrodl.v18i7.2923](https://doi.org/10.19173/irrodl.v18i7.2923)
- Veloo, R., & Masood, M. (2014). Acceptance and intention to use the iLearn system in an automotive semiconductor company in the northern region of Malaysia. *Procedia - Social and Behavioural Sciences*, 116, 1378-1382. doi: [10.1016/j.sbspro.2014.01.401](https://doi.org/10.1016/j.sbspro.2014.01.401)

- Venkatesh, V. (1999). Creation of favorable user perceptions: Exploring the role of intrinsic motivation. *MIS Quarterly*, 23(2), 239-260. doi: [10.2307/249753](https://doi.org/10.2307/249753)
- Wang, R., & Lin, Y. (2014). Push-pull factors of e-learning in the hotel industry. *Industrial Management and Data Systems*, 114(8), 1169–1185. doi: [10.1108/IMDS-07-2014-0200](https://doi.org/10.1108/IMDS-07-2014-0200)
- Wei, W.- C. (2009). A technology acceptance model: Mediate and moderate effect. *Asia Pacific Management Review*, 14(4), 461-476. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.461.3717&rep=rep1&type=pdf>
- Werkel, M., Schmidt, M., Dikke, D., & Schwantzer, S. (2015). Case study 4: Technology enhanced workplace learning. In S. Kroop, A. Mikroyannidis, & M. Wolpers (Eds.), *Responsive Open Learning Environments* (pp. 159-184). Retrieved from <http://library.oapen.org/bitstream/id/97deab28-eb8d-4204-95b3-153363c2bd80/1002016.pdf#page=183>
- Yoo, S. J., & Huang, W. D. (2016). Can e-learning system enhance learning culture in the workplace? A comparison among companies in South Korea. *British Journal of Educational Technology*, 47(4), 575-591. doi: [10.1111/bjet.12240](https://doi.org/10.1111/bjet.12240)
- Yuen, A. H. K., & Ma, W. W. K. (2008). Exploring teacher acceptance of e-learning technology. *Asia-Pacific Journal of Teacher Education*. 36(3), 229-243. doi: [10.1080/13598660802232779](https://doi.org/10.1080/13598660802232779)
- Zhao, X., Lynch, J. G., & Chen, Q. (2010). Reconsidering Baron and Kenny: Myths and truths about mediation analysis. *Journal of Consumer Research*, 37(2), 197-206. doi: [10.1086/651257](https://doi.org/10.1086/651257)
- Zheng, J., & Li, S. (2020). What drives students' intention to use tablet computers: An extended technology acceptance model. *International Journal of Educational Research*, 102, 101612. doi: [10.1016/j.ijer.2020.101612](https://doi.org/10.1016/j.ijer.2020.101612)
- Zogheib, B., Rabaa'i, A., Zogheib, S., & Elsayehi, A. (2015). University student perceptions of technology use in mathematics learning. *Journal of Information Technology Education: Research*, 14, 417-438. doi: [10.28945/2315](https://doi.org/10.28945/2315)

